

# Guideline Interaction: a study of interactions among drug-disease contraindication rules

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**Objective.** To study the interactions among the drug-disease contraindication guidelines in a real clinical settings by using clinical databases.

**Background.** Implementing paper-based clinical guidelines into a computer-based system is believed to increase the percentage of guideline adoption. However, most of the ideas concerning guideline implementation in a computerized environment are still being developed for research purposes and not yet applied to the actual clinical settings<sup>1</sup>. Besides, it is known that interactions among rules can be a potential problem causing unexpected behaviors in a rule-based system<sup>2</sup>. Guideline interaction occurs when one new clinical finding triggers more than one guideline. These common components can have identical, different or contradictory meanings. This study uses clinical drug and disease databases to characterize the magnitude of guideline interactions of drug-disease contraindication rules.

**Methods.** We conducted this guideline interaction study by adopting the 50 drug-disease interaction rules for geriatric population by Hanlon et al<sup>3</sup>. Each rule is regarded as a guideline, and has a drug class and a disease class component. We classify the guideline interactions among drug-disease interaction rules into four categories: (I) one drug class occurs in two different drug-disease interaction rules, (II) one disease class occurs in two different drug-disease interaction rules, (III) two distinct drug classes, each one pairing in a distinct drug-disease interaction rule, share some common subclass or component drugs, and (IV) two distinct disease classes, each occurring in a distinct drug-disease interaction rule, share some common subclass or component diseases. A drug-disease contraindication rule is triggered from the databases when the timestamp of the disease precedes the timestamp of the contraindicated drug. All occurrences of the different types of guideline interactions were found by querying the Columbia Presbyterian Hospital administrative databases (from January 1994 to July 2002)

**Results. Knowledge base Study--** In the 50 drug-disease interaction rules, there are 32 drug classes and 20 disease classes. If two guideline rules are paired randomly, there are 1225 ( $_{50}C_2$ ) combinations of rule pairings. Based on our classification, 33 pairs (2.7%) of drug-disease interaction rules have a drug class in common (Type I). Seventy-four pairs (6.0%) have a common disease class (Type II). Among the 32 drug

classes ( $_{32}C_2$ , 496 combinations), 8 pairs (1.6%) share some common drug(s) (Type III). There is no Type IV interaction in our drug-disease interaction rule set.

**Database Study—** We analyzed ten years of in-patient data from the Columbia Presbyterian Hospital using in clinical warehouse from the billing and the pharmacy databases. In Type I interactions, medication orders would generate a double alert when the drug in common was given to an over-65-year-old patient having both the contraindicated diseases. (Table 1) In Type II interactions, a second drug-disease alert, similar to a previous alert caused by the same contraindicated disease but a different drug class, would be generated. We used 30 days between these two alerts as the cutoff point for Type II interactions. (Table 2) Type III interactions affect a smaller proportion of patients. Among the eight pairs of type III interactions, five of them did not occur in any patient.

Table 1

Double alerts/ All orders for a certain drug class	No. of interaction drug classes involved
>5%	7
0-5%	23
0	3

Table 2

Second alerts/ All orders for a certain drug class	No. of interaction drug classes involved
>5%	18
0-5%	61
0	69

**Conclusions.** Guideline interactions will likely be problematic as the increasing number of published guidelines will be implemented in clinical decision support systems. They usually occur unnoticed. We are investigating the pre and post-coordination of alerts and guidelines, as these are likely the solution to this problem we characterized.

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